

CLAIMS

1. A water-in-oil-in-water multiple emulsion comprising a continuous aqueous phase having dispersed therein oil phase droplets wherein each oil phase droplet contains an inner dispersion of aqueous phase droplets, a water-soluble or water-dispersible active material being dissolved or dispersed in the inner dispersion of aqueous phase droplets and at least one of (a) the inner dispersion of aqueous phase droplets and (b) the oil phase droplets being encapsulated within a polymer wall material.
2. A water-in-oil-in-water multiple emulsion according to claim 1 wherein the polymer wall material is the product of a reaction or interaction between two or more polymer precursor materials.
3. A water-in-oil-in-water multiple emulsion according to claim 2 wherein polymer wall material is the product of the reaction between an oil-soluble isocyanate and an water-soluble isocyanate-reactive polymer precursor wherein
  - i) the oil phase droplets are encapsulated within a polymer wall material formed by interfacial polymerisation of the oil-soluble isocyanate dissolved in the oil phase droplets and the isocyanate-reactive polymer precursor dissolved in the continuous aqueous phase or
  - ii) the inner aqueous phase droplets are encapsulated within a polymer wall material formed by interfacial polymerisation of a first isocyanate-reactive polymer precursor dissolved in the inner aqueous phase and the oil-soluble isocyanate dissolved in the oil phase droplets and the oil phase droplets are further encapsulated within a polymer wall material formed by interfacial polymerisation of a second isocyanate-reactive polymer precursor dissolved in the continuous aqueous phase and the oil-soluble isocyanate dissolved in the oil phase droplets.
4. A water-in-oil-in-water multiple emulsion according to claim 3 wherein the oil-soluble isocyanate is toluene diisocyanate or poly(methylene) poly(phenyl) isocyanate and the water-soluble isocyanate-reactive polymer precursor is diethylenetriamine, aminoethylpiperazine or tetraethylene pentamine.
5. A water-in-oil-in-water multiple emulsion according to claim 2 wherein both the inner aqueous phase droplets and the oil phase droplets are encapsulated within a polymer wall material which is the product of heating an oil-soluble isocyanate and an oil-soluble cross-linking agent in the presence of interfacial water.

6. A water-in-oil-in-water multiple emulsion according to claim 5 wherein the oil-soluble isocyanate is toluene diisocyanate and the oil-soluble cross-linking agent is [polymethylene](polyphenylisocyanate).

7. A method of preparing a water-in-oil-in-water multiple emulsion comprising a continuous aqueous phase having dispersed therein oil phase droplets wherein each oil phase droplet contains an inner dispersion of aqueous phase droplets, a water-soluble or water-dispersible active material being dissolved or dispersed in the inner dispersion of aqueous phase droplets and at least one of (a) the inner dispersion of aqueous phase droplets and (b) the oil phase droplets being encapsulated within a polymer wall material, which method comprises

i) forming a water-in-oil emulsion in which an aqueous solution or dispersion of the active material is emulsified in an oil phase containing a predominantly oil-soluble polymer precursor and emulsifying the water-in-oil emulsion into an aqueous phase containing a predominantly water-soluble polymer precursor such that interfacial polymerisation takes place to form a polymer wall encapsulating the dispersed oil droplets; or

ii) forming a water-in-oil emulsion in which an aqueous solution or dispersion of the active material is emulsified in an oil phase containing a first predominantly water-soluble polymer precursor, adding a predominantly oil-soluble polymer precursor whereby the polymer precursors undergo interfacial polymerisation to microencapsulate the dispersed aqueous droplets and thereafter emulsifying the resultant encapsulated water-in-oil emulsion into an aqueous phase; or

iii) forming a water-in-oil emulsion in which an aqueous solution or dispersion of the active material is emulsified in an oil phase containing a first predominantly water-soluble polymer precursor, adding a predominantly oil-soluble polymer precursor whereby the polymer precursors undergo interfacial polymerisation to microencapsulate the dispersed aqueous droplets and thereafter emulsifying the resultant encapsulated water-in-oil emulsion into an aqueous phase containing a second predominantly water-soluble polymer precursor, optionally with the addition of further oil-soluble polymer precursor, such that further interfacial polymerisation takes place to form a polymer wall encapsulating the dispersed oil droplets; or

iv) forming a water-in-oil-in-water emulsion comprising a continuous aqueous phase having dispersed therein oil phase droplets wherein each oil phase droplet

contains an inner dispersion of aqueous phase droplets, a water-soluble or water-dispersible active material being dissolved or dispersed in the inner dispersion of aqueous phase droplets wherein the oil phase contains a first oil-soluble polymer precursor and a second oil-soluble polymer precursor which together form a polymer material when heated in the presence of water and heating the emulsion to form a polymer at the oil-water interfaces.

8. A method according to claim 7 wherein the oil-soluble polymer is an isocyanate.
9. A water-in-oil-in-water emulsion according to any of claims 1 to 6 or a method according to any of claims 7 and 8 wherein a water-soluble electrolyte is added to the continuous aqueous phase to balance the osmotic potential between the inner dispersed aqueous phase and the outer continuous aqueous phase.
10. A water-in-oil-in-water emulsion according to any of claims 1 to 6 and 9 or a method according to any of claims 7, 8 and 9 wherein the active material is paraquat, diquat, glyphosate, 2,4-D, clopyralid, MCPA, CMPP, triclopyr, fluroxypyr as their water soluble salts, fomesafen and its water soluble salts, chlormequat, mepiquat, dodine, guazatine, dodemorph, fenpropimorph and tridemorph and where appropriate water soluble salts and mixtures thereof.
11. A water-in-oil-in-water emulsion according to any of claims 1 to 6 and 9 or 10 or a method according to any of claims 7, 8 and 9 or 10 wherein a second water-soluble or water-dispersible active material is dissolved or dispersed in the continuous aqueous phase.
12. A water-in-oil-in-water emulsion according to any of claims 1 to 6 and 9 to 11 or a method according to any of claims 7, 8 and 9 to 11 wherein the oil forming the oil phase is a mineral oil, paraffin oil, diesel oil, vegetable oil or an esterified vegetable oil.
13. A method according to any of claims 7, 8 and 9 to 12 wherein the initial water-in-oil emulsion is formed in the presence of a first surfactant system and the water-in-oil emulsion thus formed is emulsified into a continuous aqueous phase using a second surfactant system.